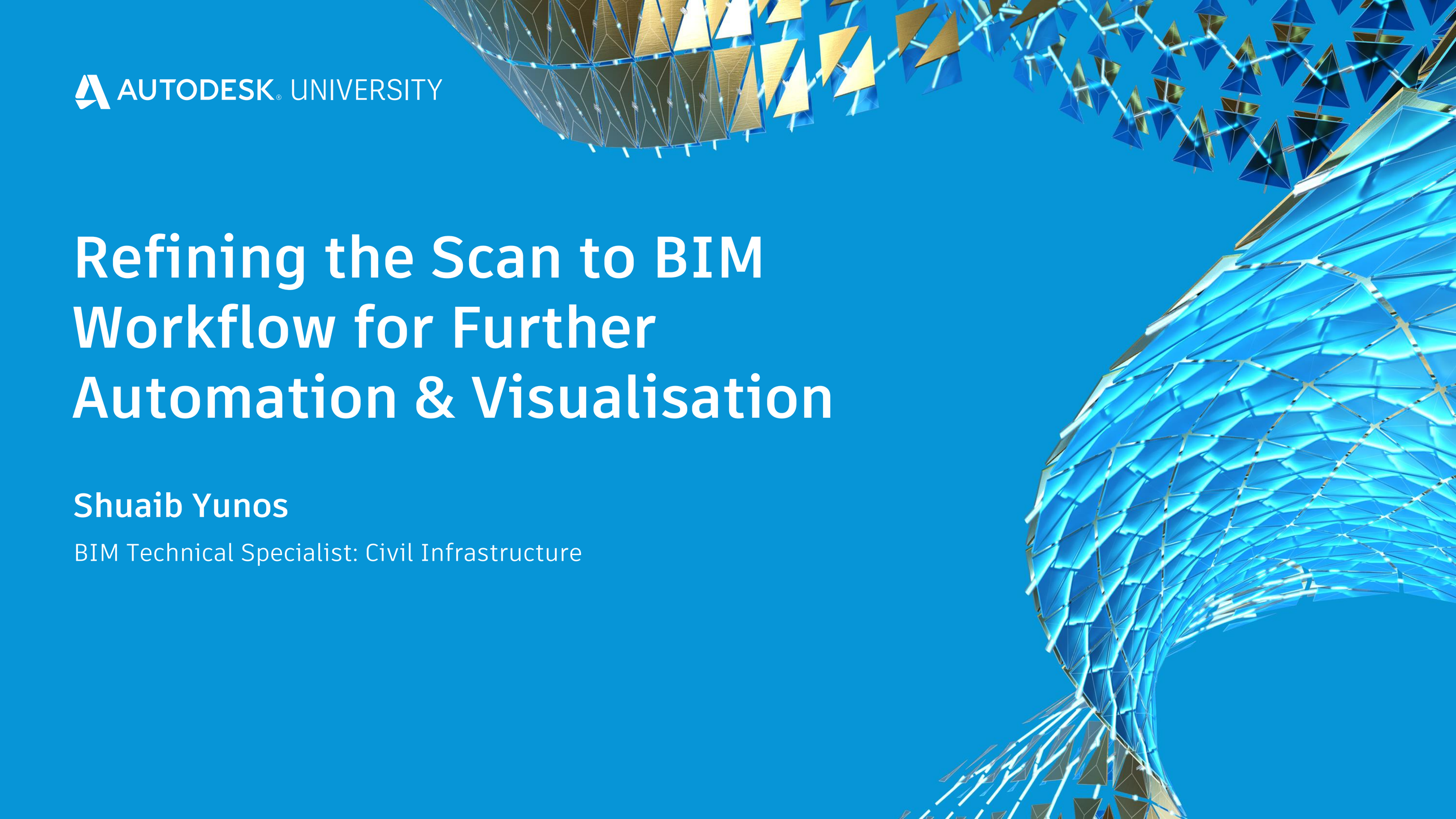
AUTODESK. UNIVERSITY

Refining the Scan to BIM Workflow for Further Automation & Visualisation

Shuaib Yunos

BIM Technical Specialist: Civil Infrastructure



Shuaib Yunos

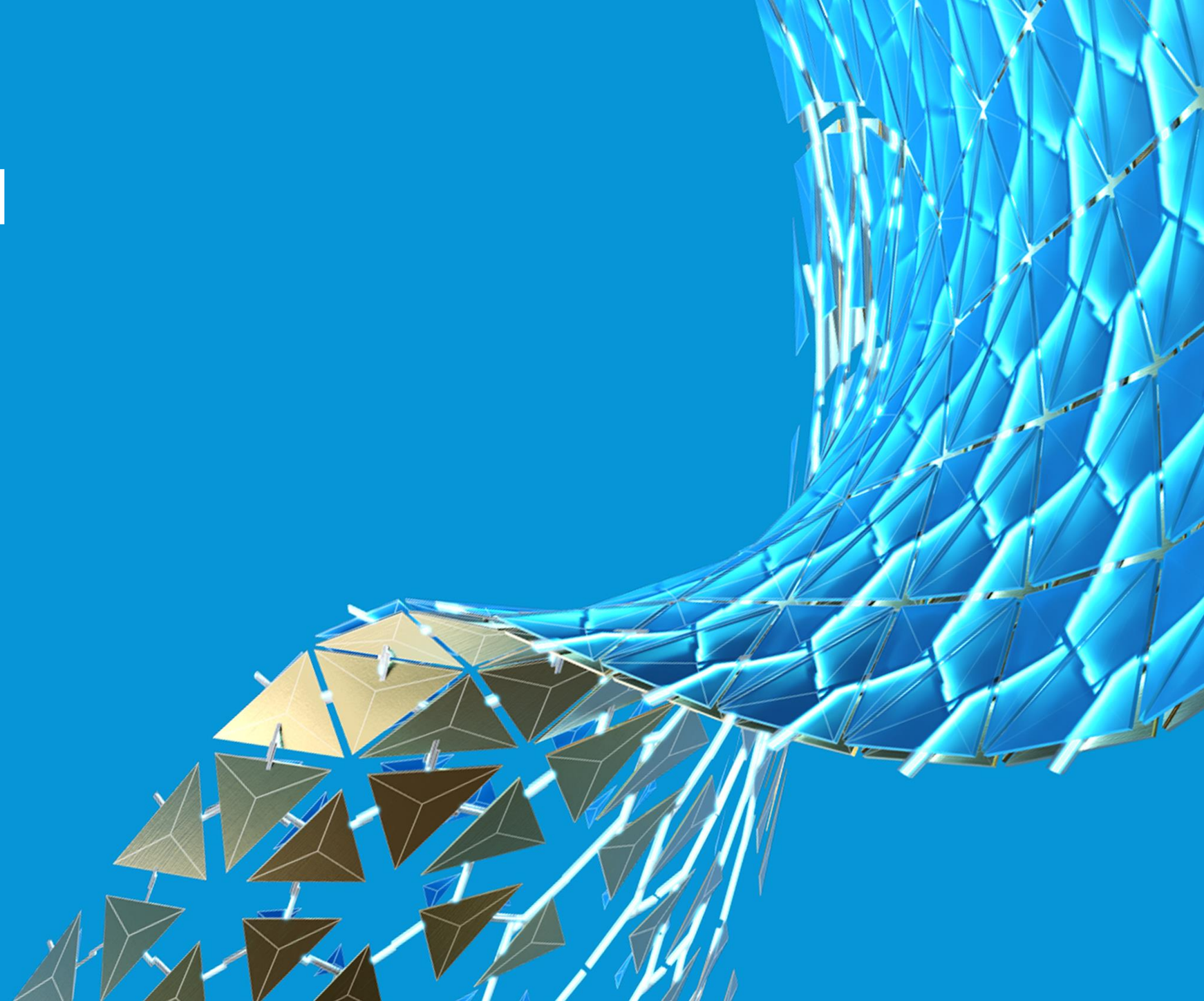
BIM Technical Specialist: Civil Infrastructure, Baker Baynes

- Based in Johannesburg, South Africa
- Civil Design Specialist, Civil Design Technologist, Civil Engineering Consultant & Autodesk Certified Instructor
- Presented at many events & professional bodies across the globe such as SAICE, The SA Geotech Conference, AU Africa, as well as being selected to present at AU Las Vegas 2018
- Champion digital transformation across the Civil Infrastructure Industry in Africa and beyond

Agenda

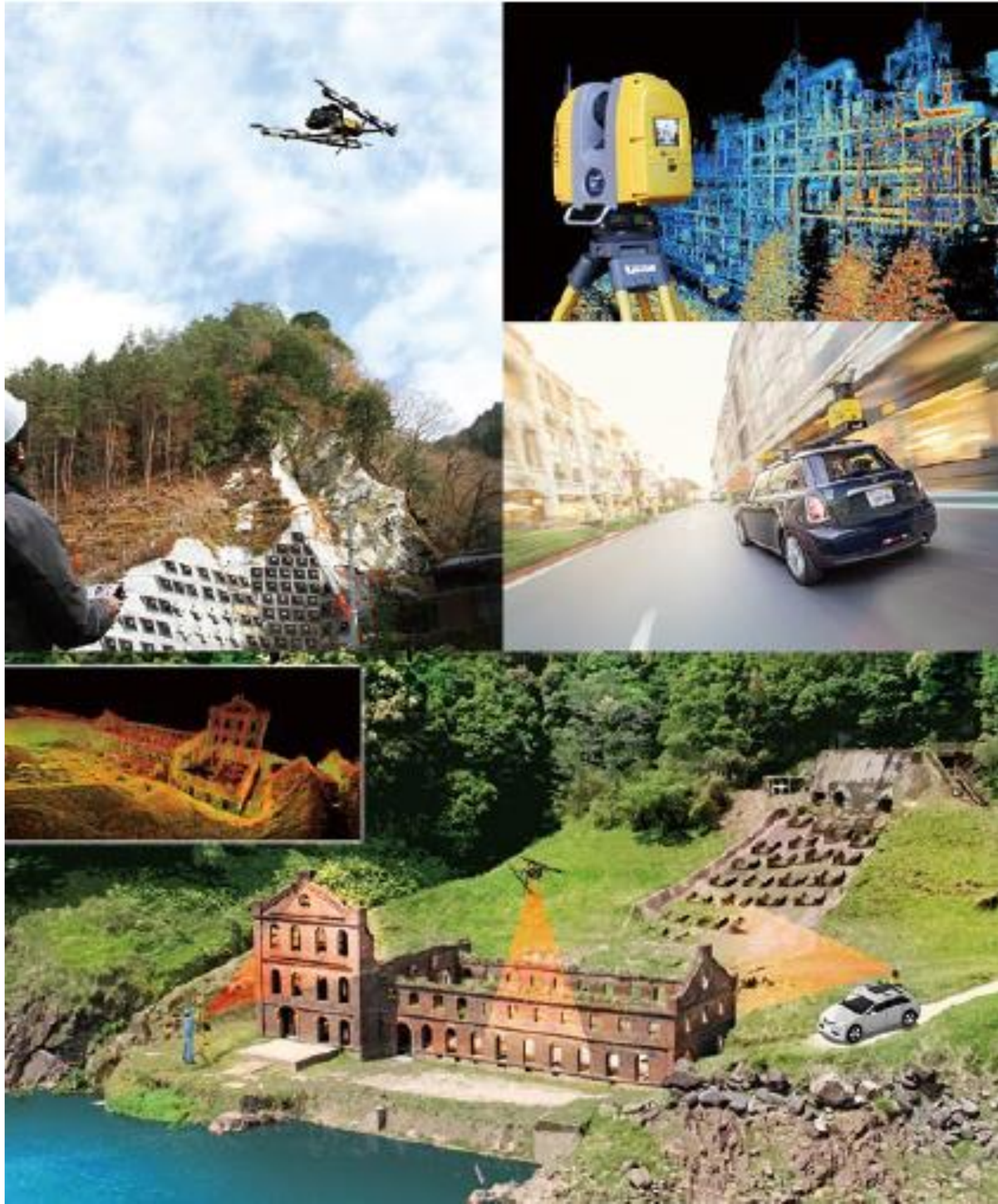
- **Scan to BIM**
  - What is it and what are the benefits?
- **The Workflows Related to Modelling & As-Built Capture**
  - Traditional
  - Scan to BIM
- **The Refined Scan to BIM Workflow for Further Automation and Visualisation**
  - Scan
  - Process
  - Extract
  - Model & Visualise
  - As - Built
- **Conclusion**

Scan to BIM



What is Scanning?

- Scanning is the use of 3D Laser Scanning technology with the objective to capture the existing environment.
- Applied across a variety of design disciplines.
- The product of a scan is a Point Cloud, consisting of millions of pixels/points with an X,Y & Z value
- The Point cloud needs to be processed, registered & verified to ensure accuracy and correctness.
- Thereafter, the processed point cloud can be imported into a design tool like Revit, Civil 3D, Inventor, AutoCAD & other authoring tools.
- Autodesk applications require that the point cloud file be in an .RCP format (Autodesk ReCap)



What is BIM?

- **BIM is an acronym for Building Information Modelling**

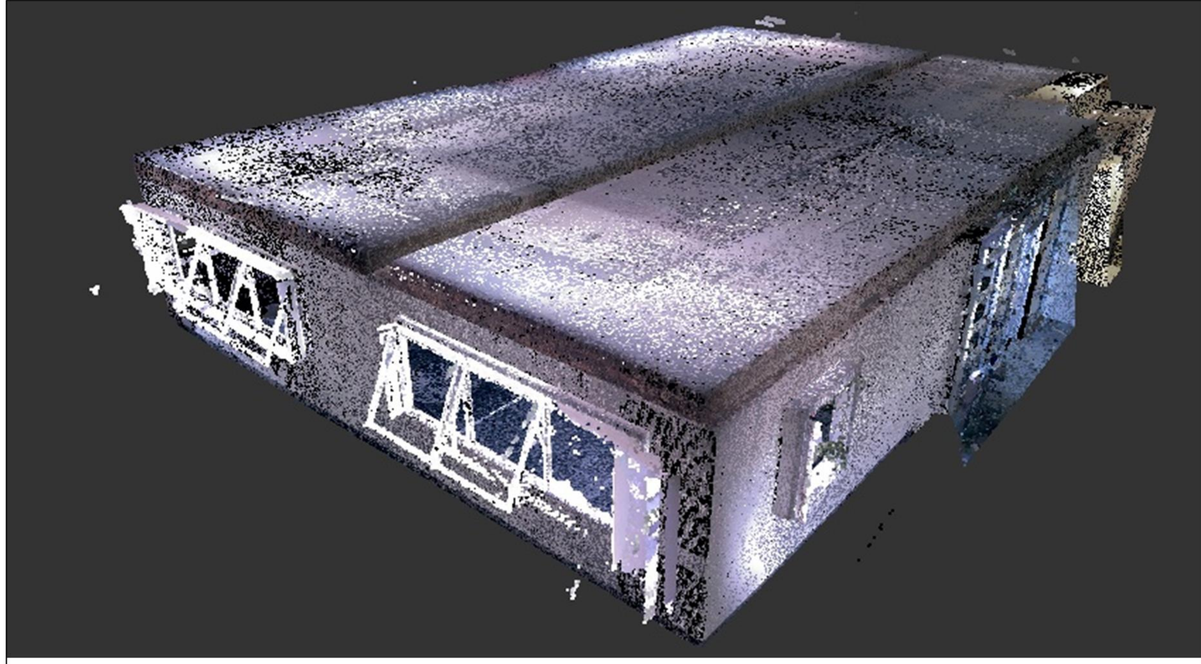
- **BIM is an intelligent 3D model-based process that gives architecture, engineering, and construction (AEC) professionals the insight and tools to more efficiently plan, design, construct, and manage buildings and infrastructure.**

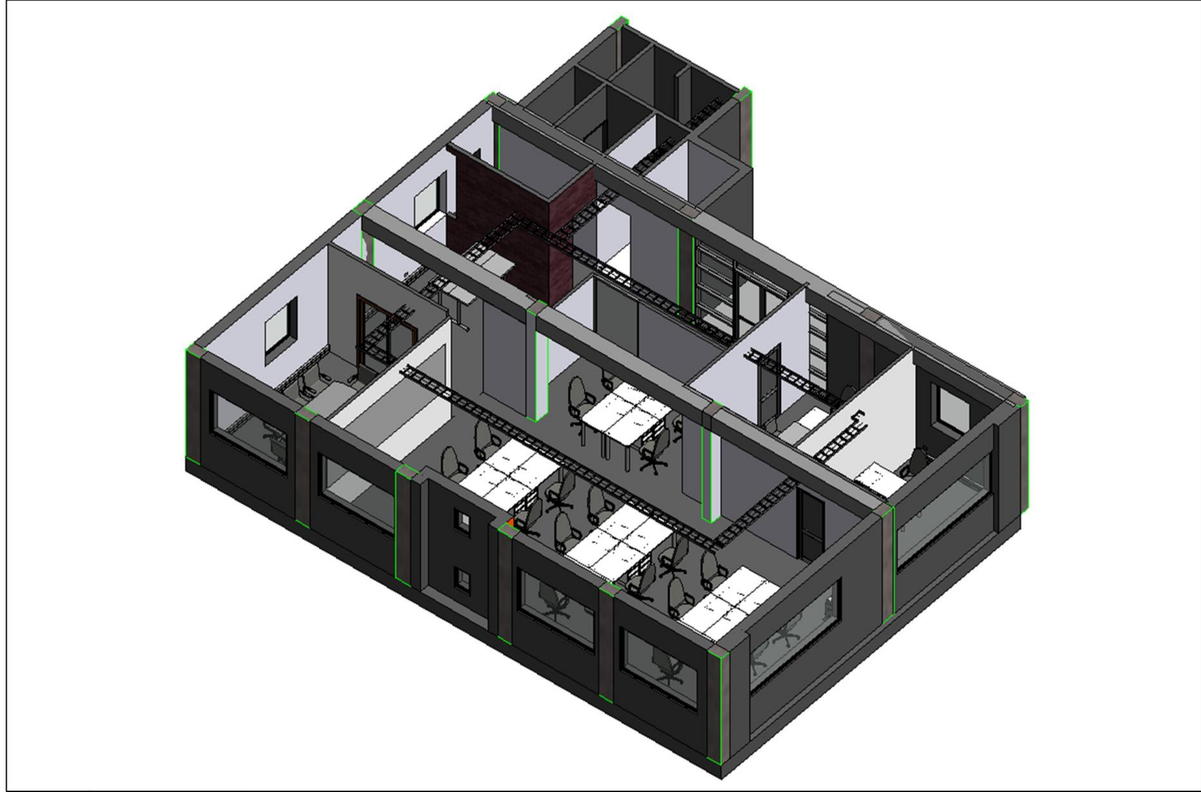
- **BIM is used to design and document building and infrastructure designs. Every detail of a building is modelled in BIM. The model can be used for analysis to explore design options and to create visualisations that help stakeholders understand what the building will look like before it's built. The model is then used to generate the design documentation for construction.**

- **BIM data can also inform planning and resourcing on the project, city or country level. This is why BIM mandates are increasing across the globe.**

What is Scan to BIM?

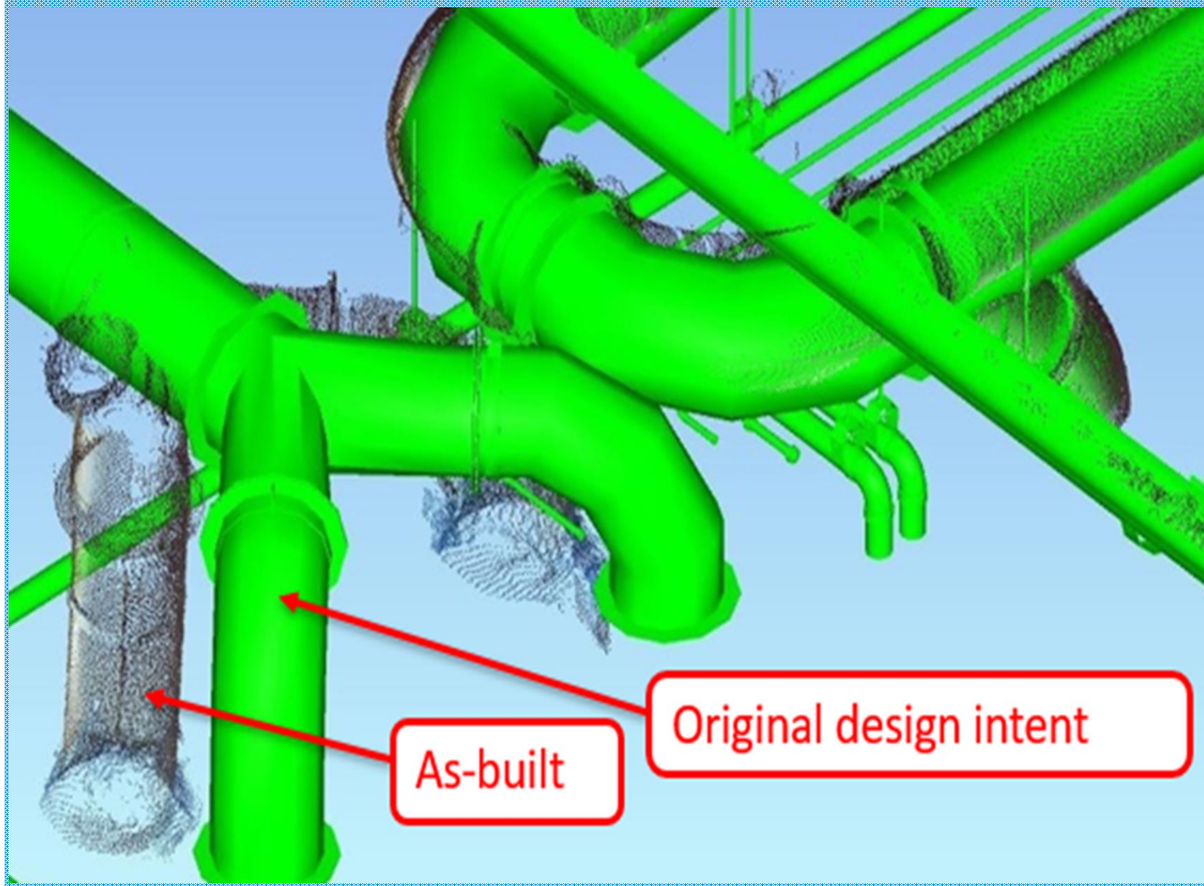
- **Scan to BIM involves the integration/application of 3D scanning technology & BIM applications and processes**
- **This results in digital capture of the existing environment and digital modelling/design relative to the task at hand**
- **Scanning or reality capture can be carried out by using fixed 3D Laser Scanners, Hand-helds, as well as Drones.**
- **Once this captured data is processed and verified, it then can be incorporated with BIM technologies for modelling, design, analysis and visualisation**



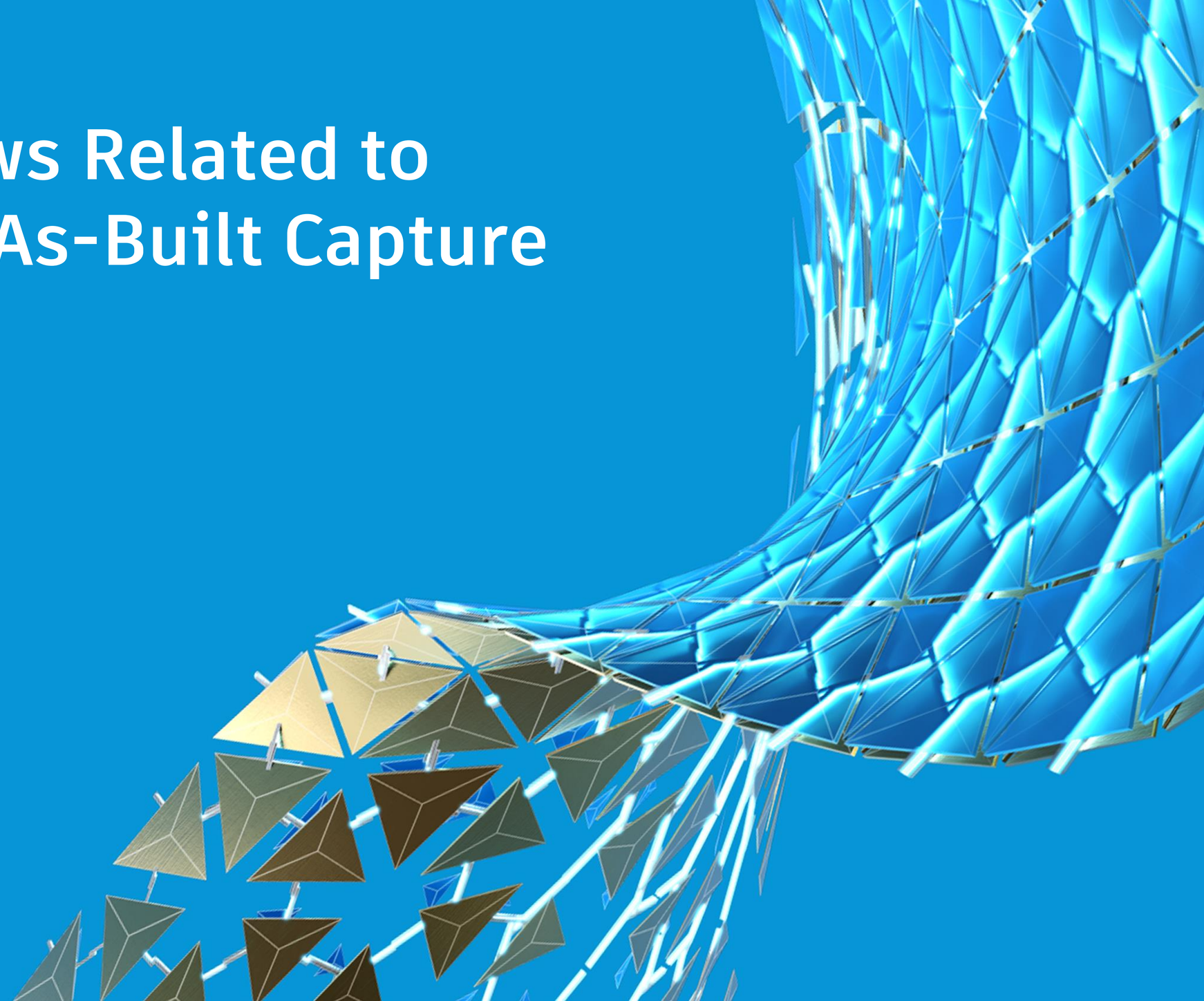


What are the Benefits of The Scan to BIM Workflow?

- **Accurately capture existing conditions as the basis for design**
- **Reduce Manual Intervention**
- **Reduce issues and change orders**
- **Quickly capture Existing Conditions in High Resolution**
- **Fewer Physical Site Visits**
- **Decreased Project Costs**
- **Reduced Rework**
- **Easier Re-designing**



The Workflows Related to Modelling & As-Built Capture



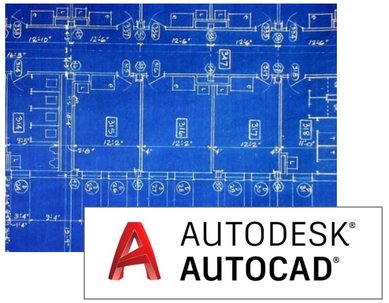
The Traditional Workflow

MANUAL MEASUREMENT & DESIGN

CONSTRUCTION COMPLETE

MANUAL AS – BUILT CAPTURE

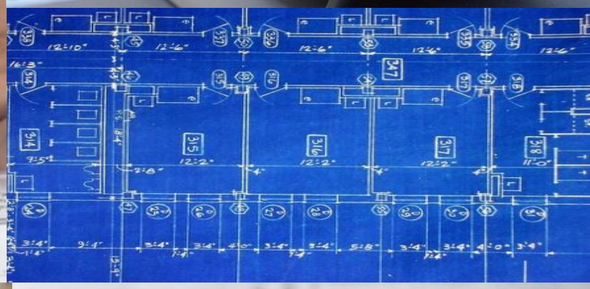
MEASUREMENTS SKETCHED MANUALLY



OVERLAYED & UPDATED MANUALLY

Challenges Faced with The Traditional Workflow

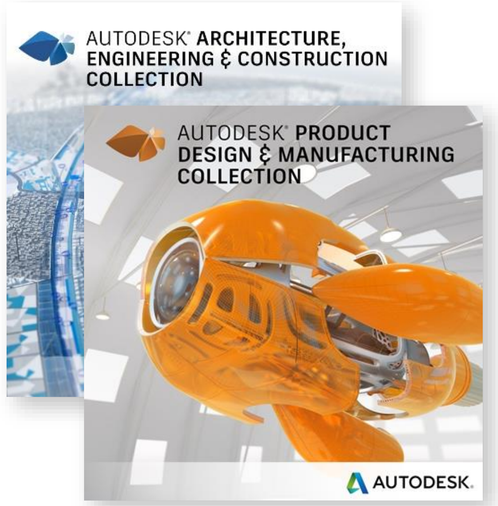
- Measurements are not accurately captured and can vary from person to person
- Heavily manual, cumbersome process to capture measurements
- Measurements written down by hand can sometimes be difficult to read or not as legible
- Measurements of certain elements can be forgotten/ missed resulting in multiple visits to site
- Inaccurate or missing information leads to increased delays and rework
- Overlaying and tracing measurements over hardcopies is a tedious, difficult task



The Scan to BIM Workflow

SCAN

PROCESS

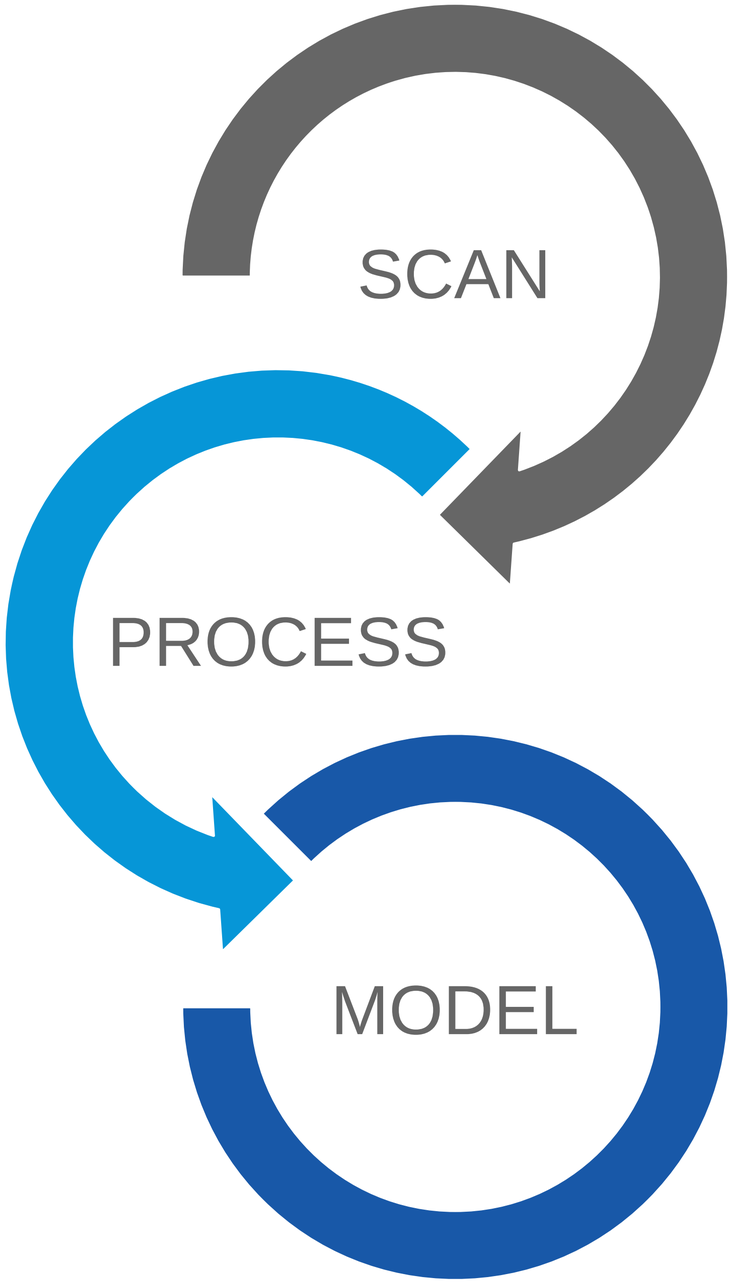


MODEL

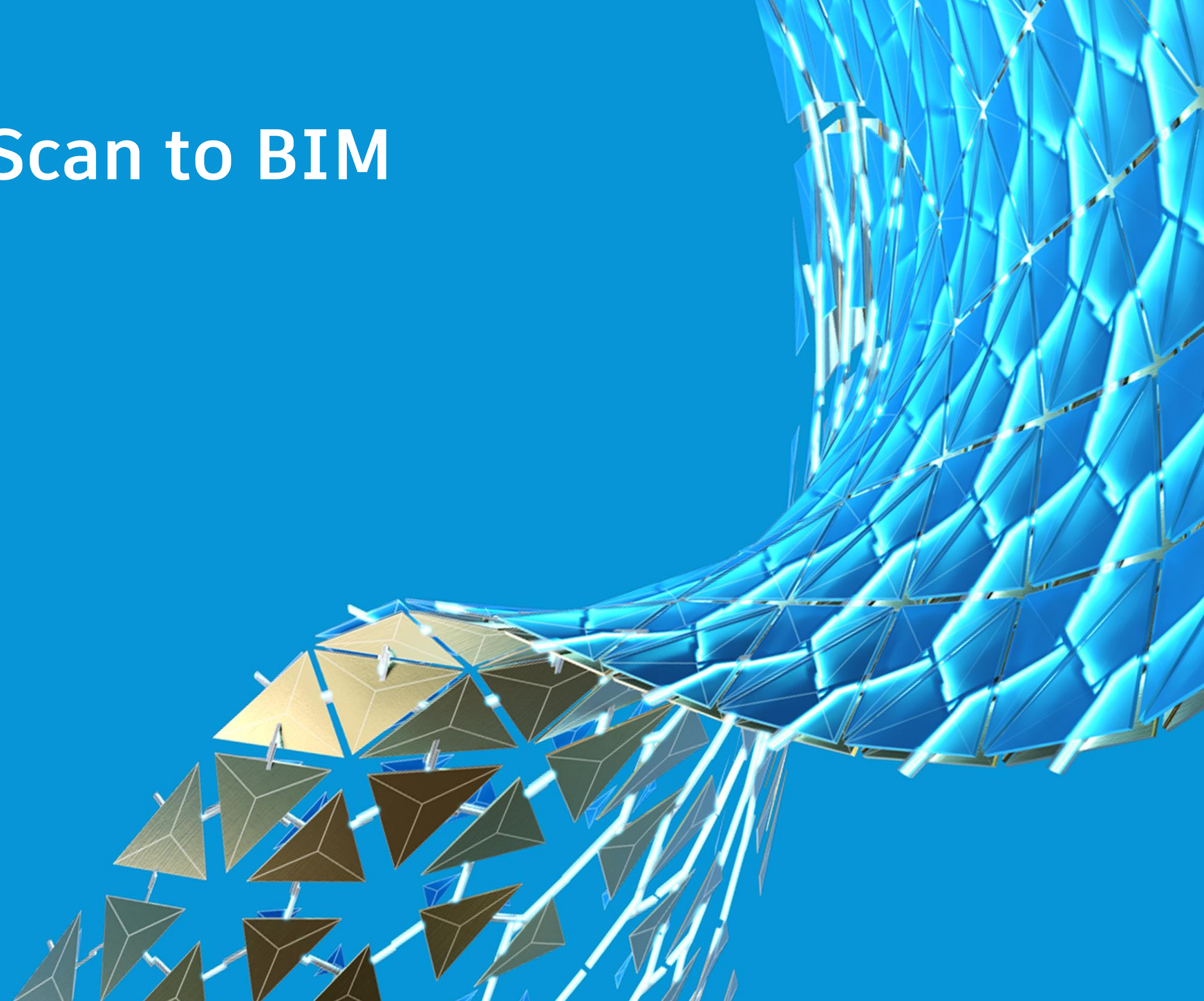
AS-BUILT

Challenges Faced with The Scan to BIM Workflow

- **Laser Scanners can be expensive based on the application and level of accuracy required – This however can be overcome by contracting this task from those specialising in this service.**
- **Laser scanning cannot be conducted outdoors during rainy weather**
- **The area to be scanned should be vacant for accurate scanning. This can be difficult to arrange in a busy building**
- **Large areas/infrastructure that are scanned result in large data sets requiring sufficient storage space and computing power to process**
- **The typical Scan to BIM Workflow lacks in the modelling phase, being completely manual by importing the point cloud and tracing/modelling off it**



The Refined Scan to BIM Workflow

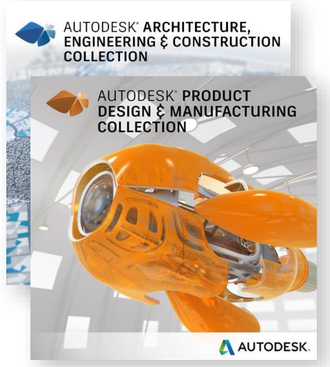


The Refined Scan to BIM Workflow for Further Automation & Visualisation

SCAN

PROCESS

EXTRACT



MODEL & VISUALISE

CONSTRUCT

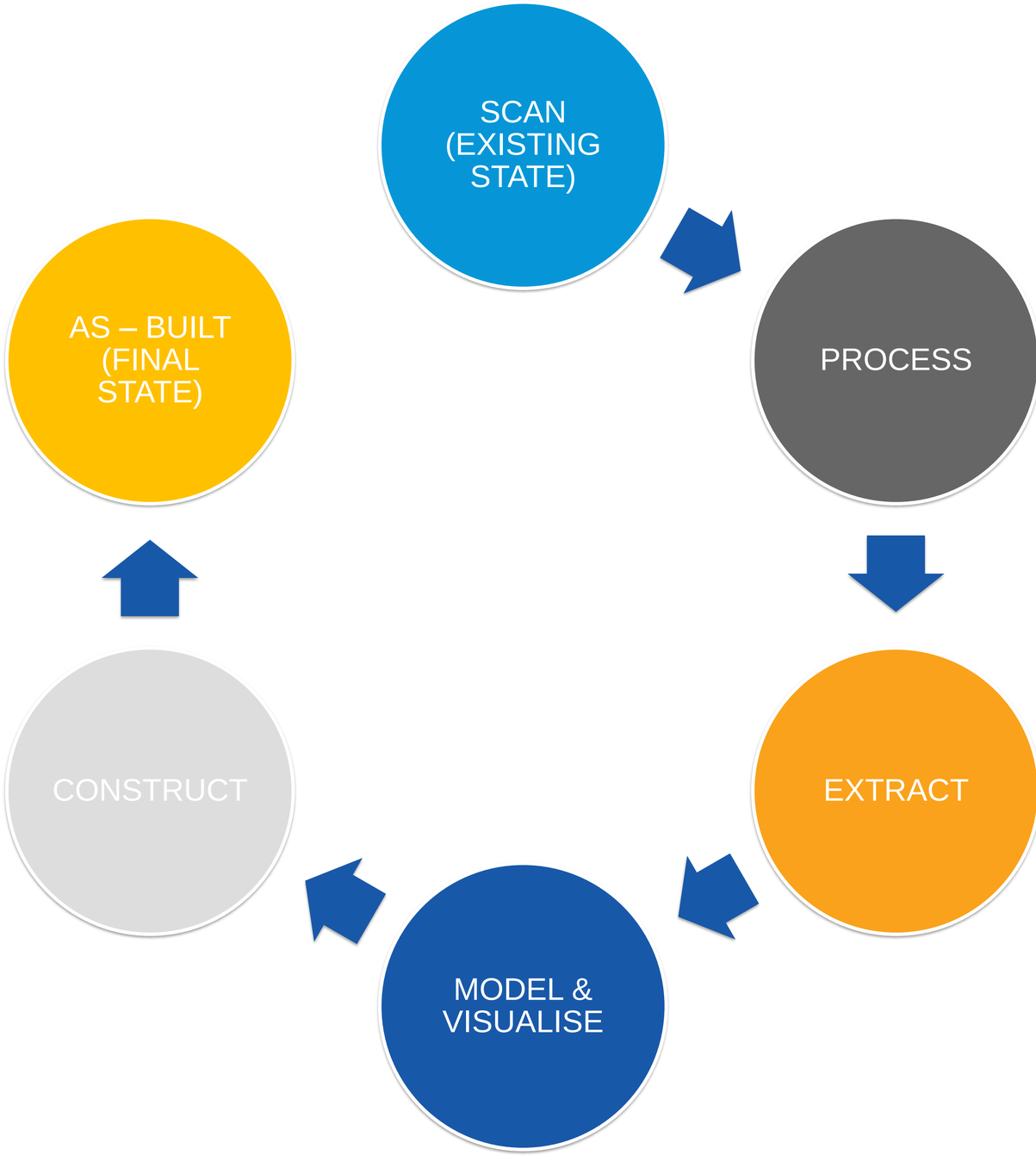
AS – BUILT

The Refined Scan to BIM Workflow for Further Automation & Visualisation

SCAN → PROCESS → EXTRACT → MODEL & VISUALISE → CONSTRUCT → AS – BUILT

Benefits of The Refined Scan to BIM Workflow

- **Measurements and as-built capture is automated using 3D laser scanning saving time and reducing site visits**
- **Processing and modelling done using BIM intelligent applications**
- **Incorporation of point cloud extraction technologies significantly reduces modelling time and complexity, further automating the overall process**
- **The incorporation of point cloud data and photogrammetry with the BIM Model results in highly accurate and realistic visualisations**

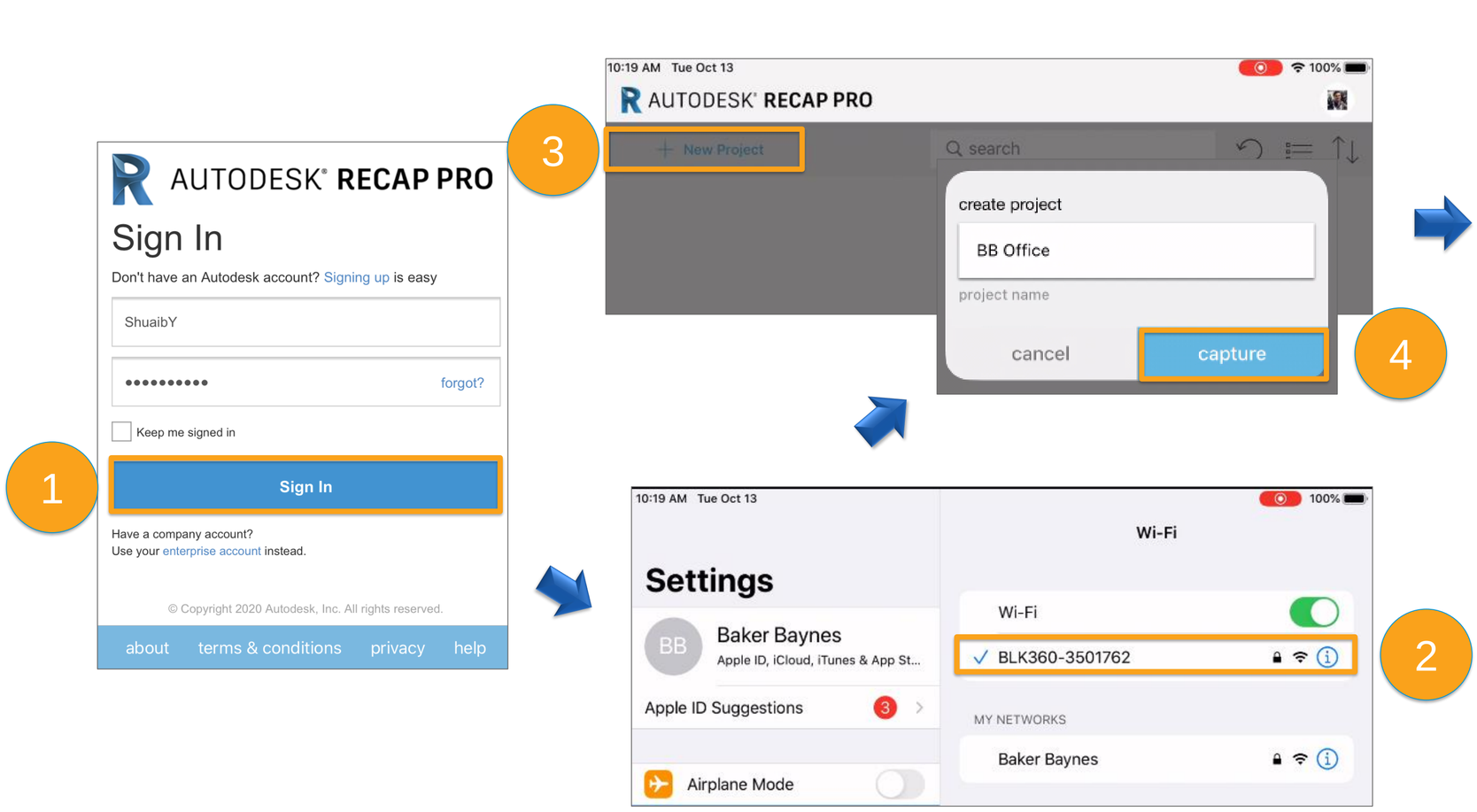


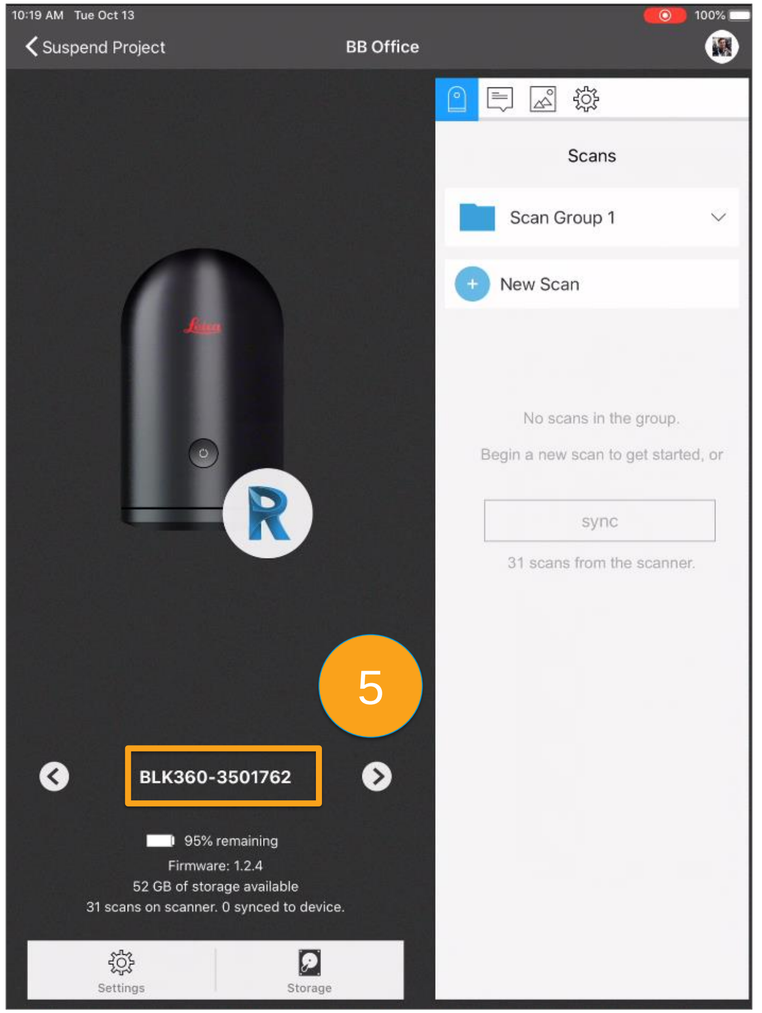
The Scenario for Today`s Session

- **Baker Baynes is moving into a new office space**
- **The prospective office space is an open plan**
- **Baker Baynes requires to plan their office layout before moving in to maximise the use of space (space planning)**
- **This will involve the placement of drywalls and office furniture**
- **Apply the Refined Scan to BIM Workflow to achieve this task comprising of as – built capture, modelling & visualisation**

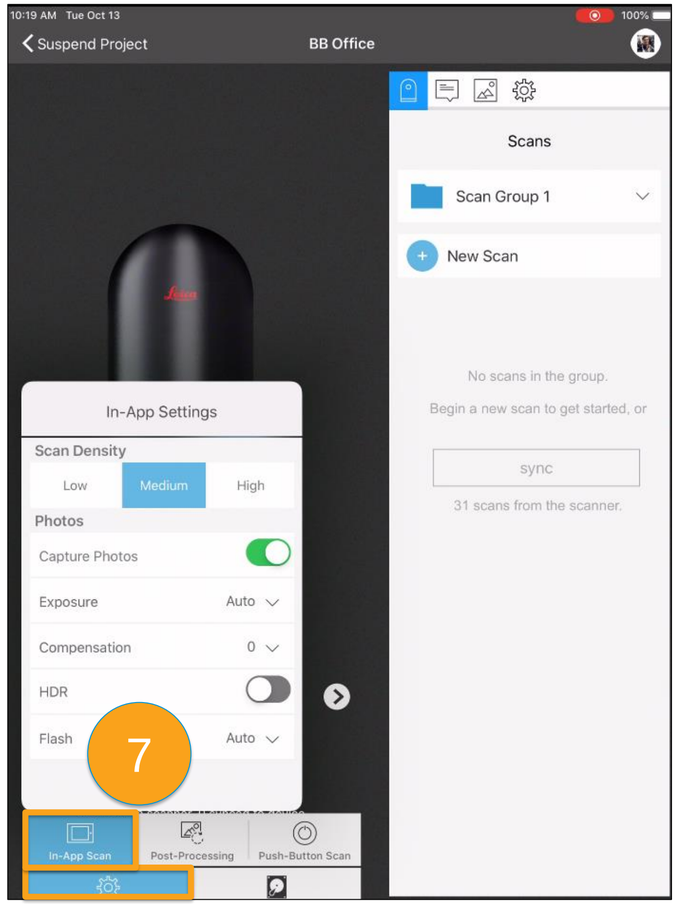
SCAN

Reality Capture using the Leica BLK360 & Autodesk ReCap Pro for Mobile





Reality Capture using the Leica BLK360 & Autodesk ReCap Pro for Mobile



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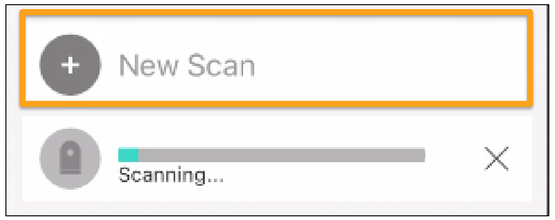
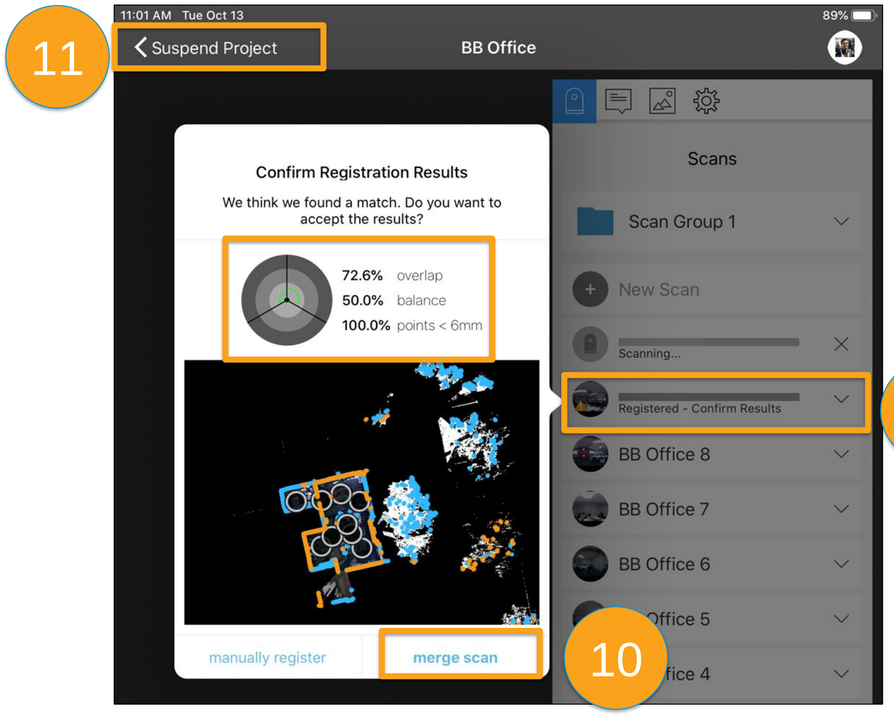
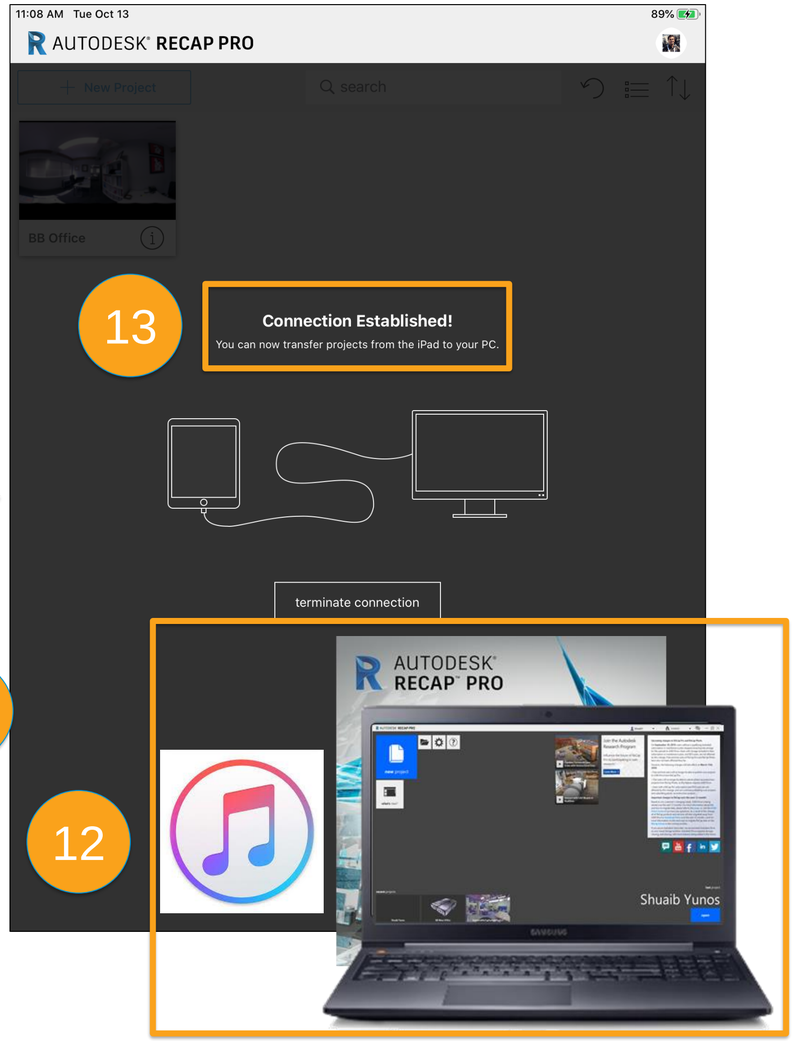
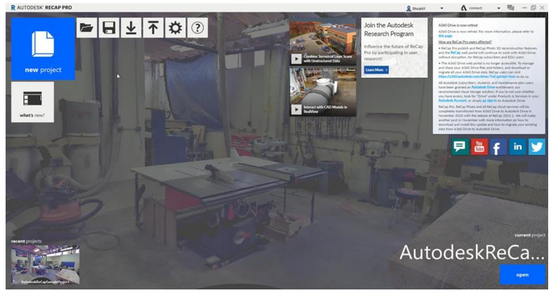






PROCESS

Processing of Captured Scanned Data with Autodesk ReCap Pro



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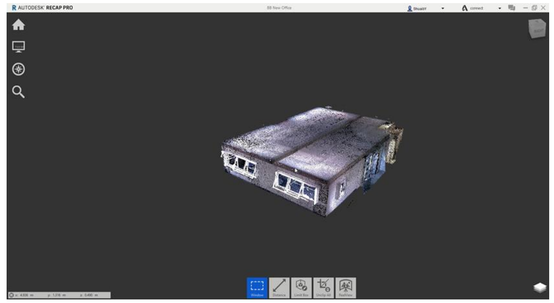
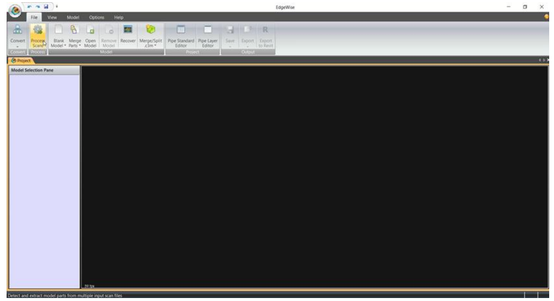
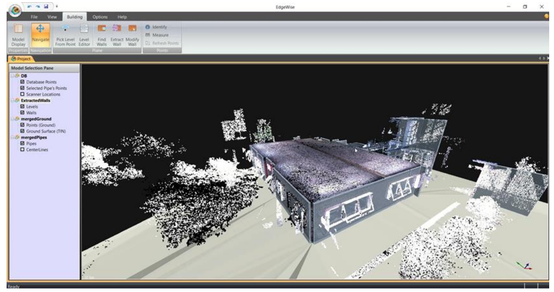


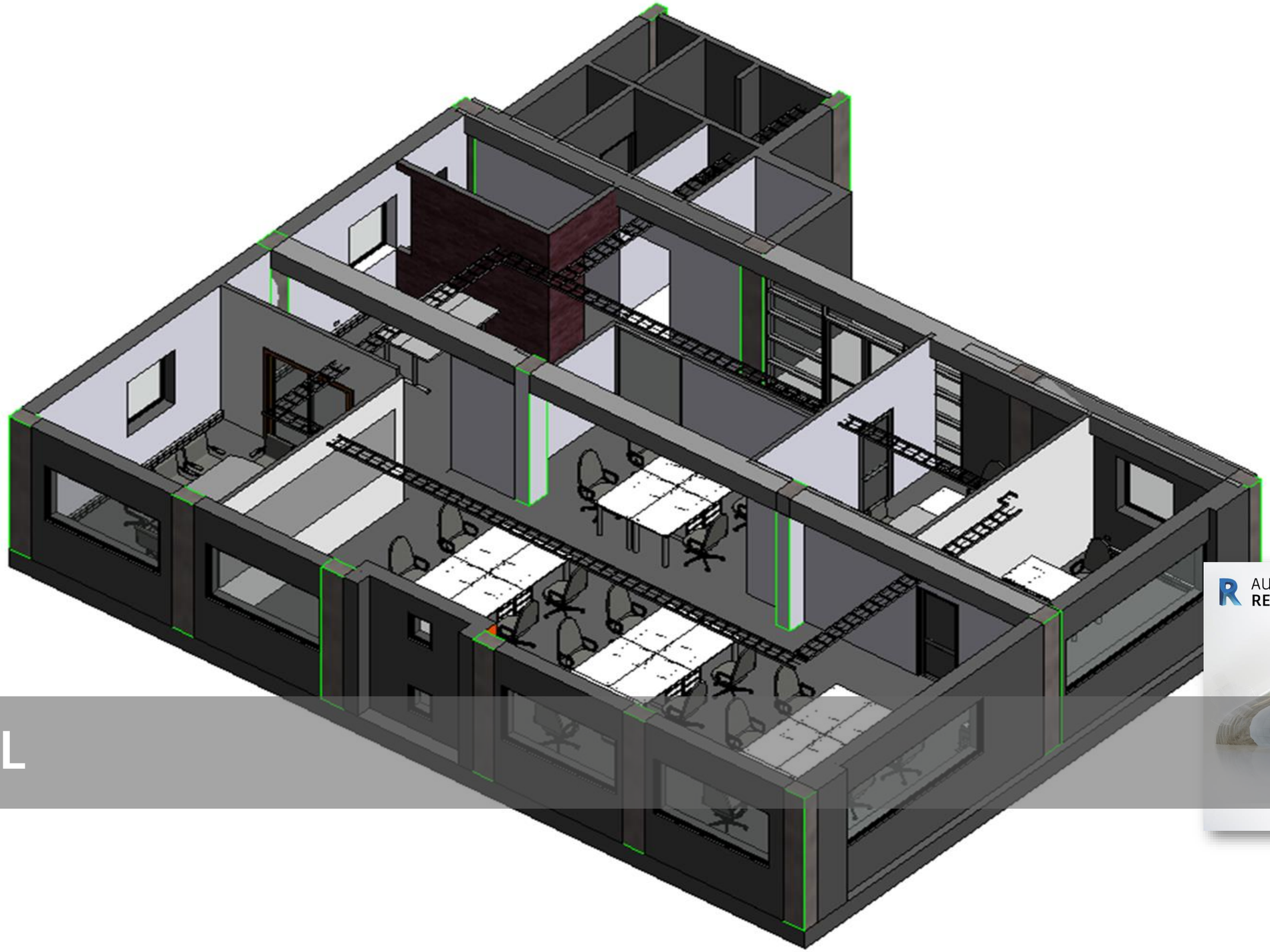
EXTRACT

Automated Extraction of Point Cloud Elements with ClearEdge3D EdgeWise



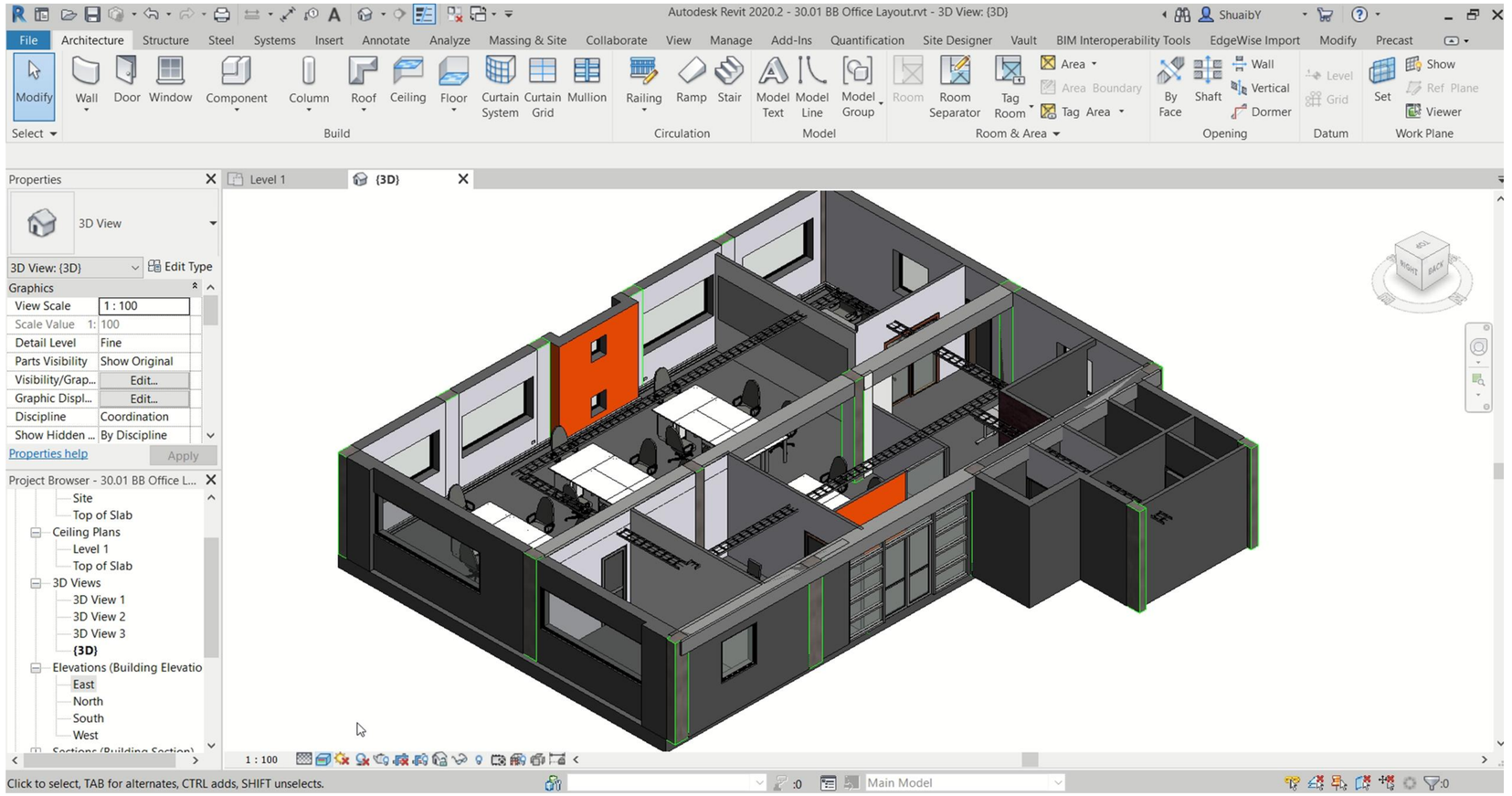
Automated Extraction of Point Cloud Elements with ClearEdge3D EdgeWise





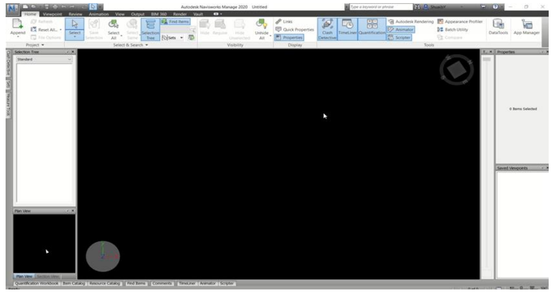
MODEL

Modelling of the Building Complete in Autodesk Revit

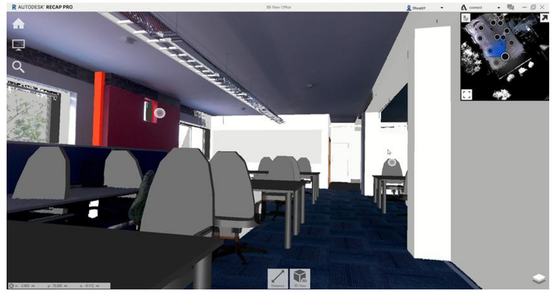


VISUALISATION

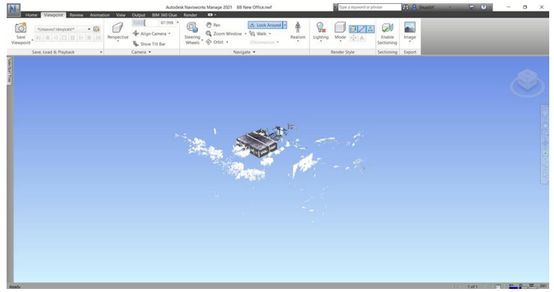
Visualisation with Autodesk ReCap Pro & Navisworks



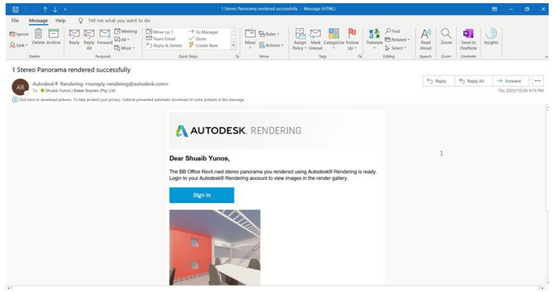
Visualisation with Autodesk ReCap Pro & Navisworks



Visualisation with Autodesk ReCap Pro & Navisworks



Visualisation with Autodesk ReCap Pro & Navisworks



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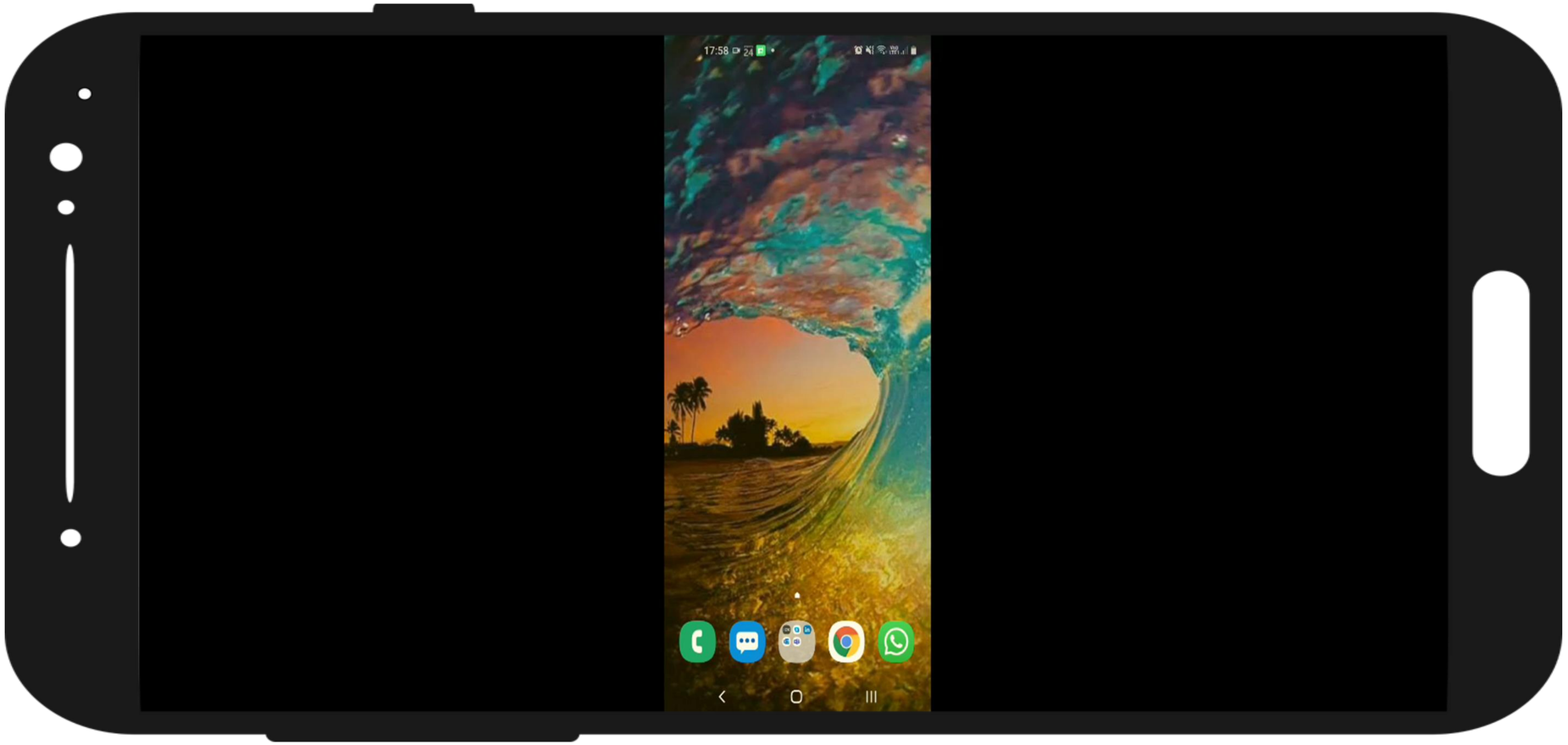
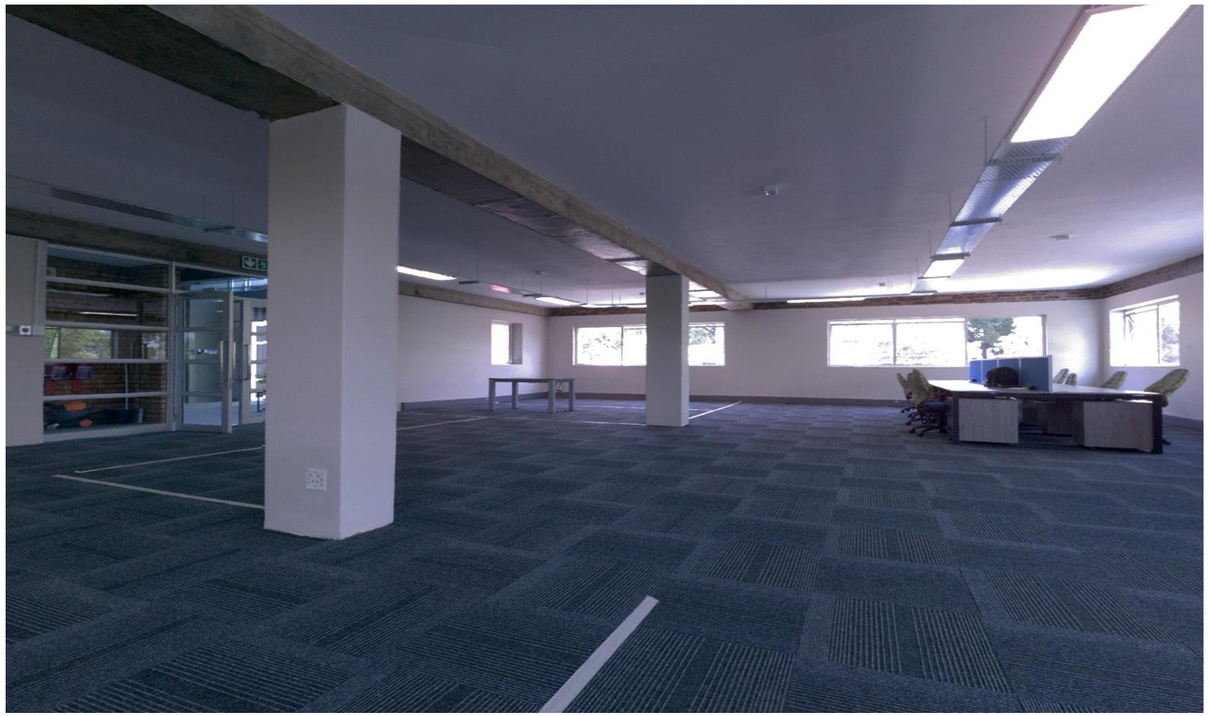
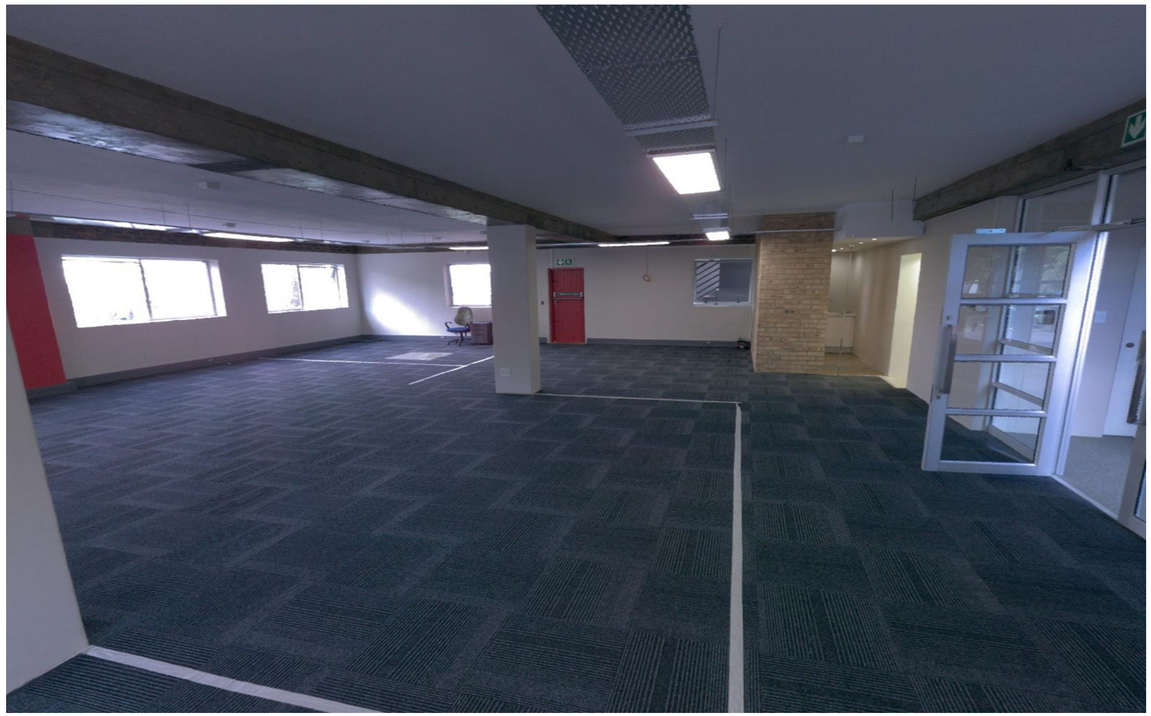


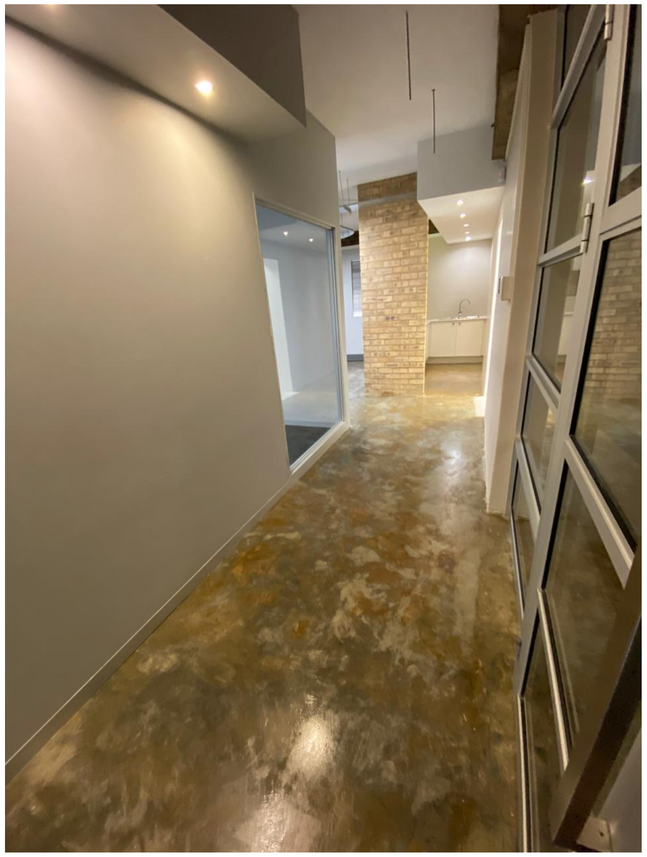
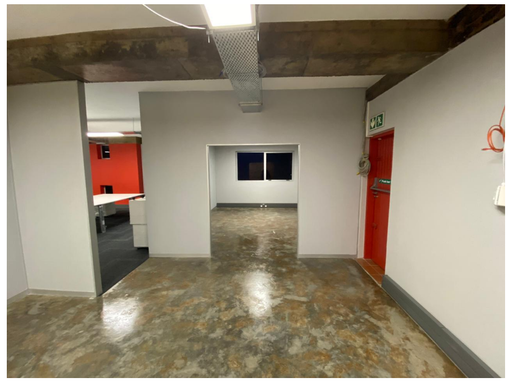
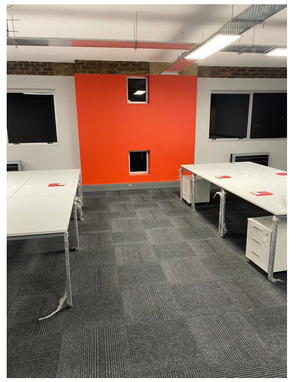
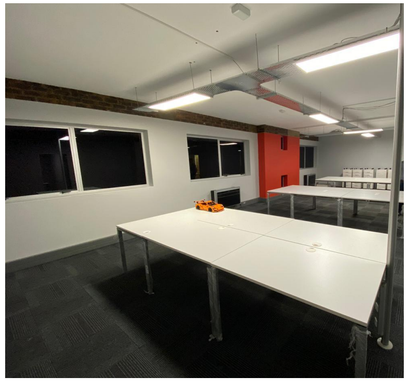
CONSTRUCT

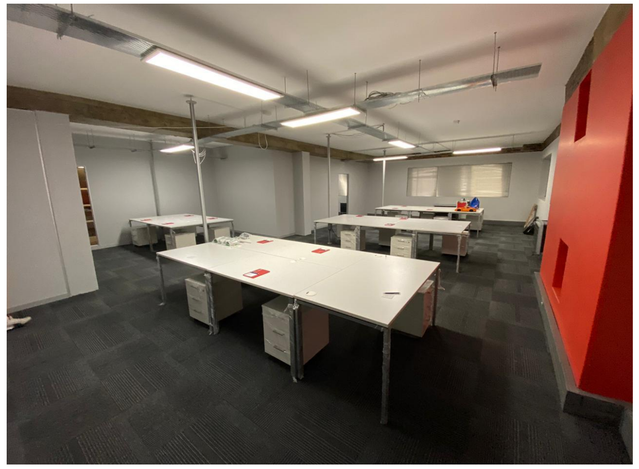
Before Construction

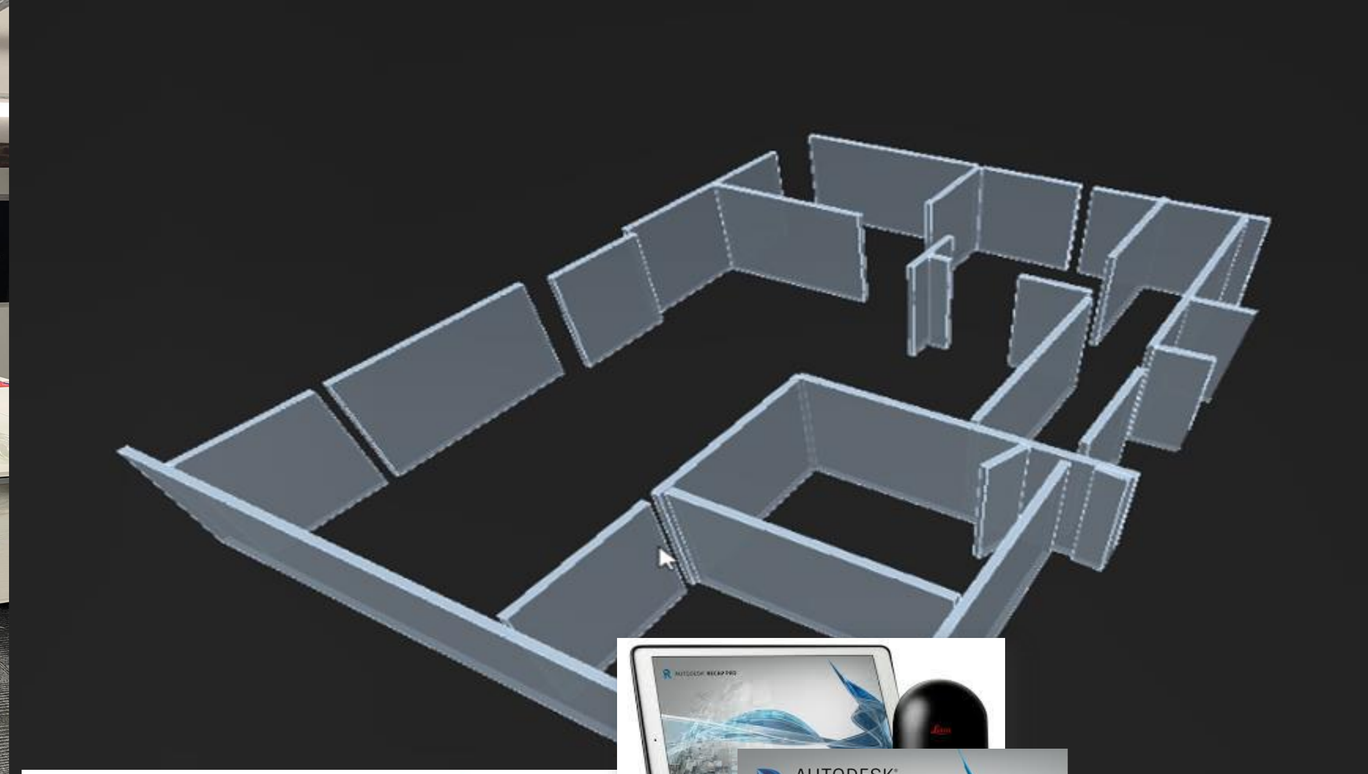


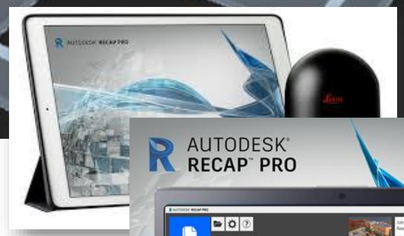


The Construction of the Office is Complete

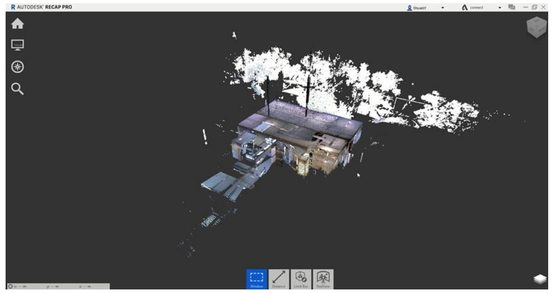






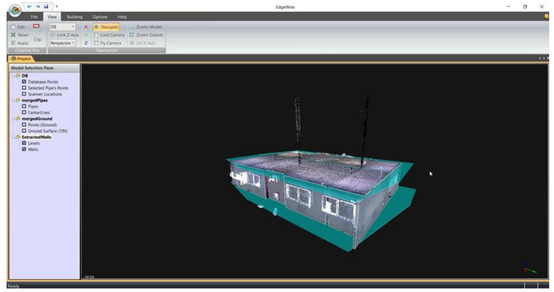
AS – BUILT CAPTURE & MODELLING

Constructed Office is Scanned (As – Built Capture)

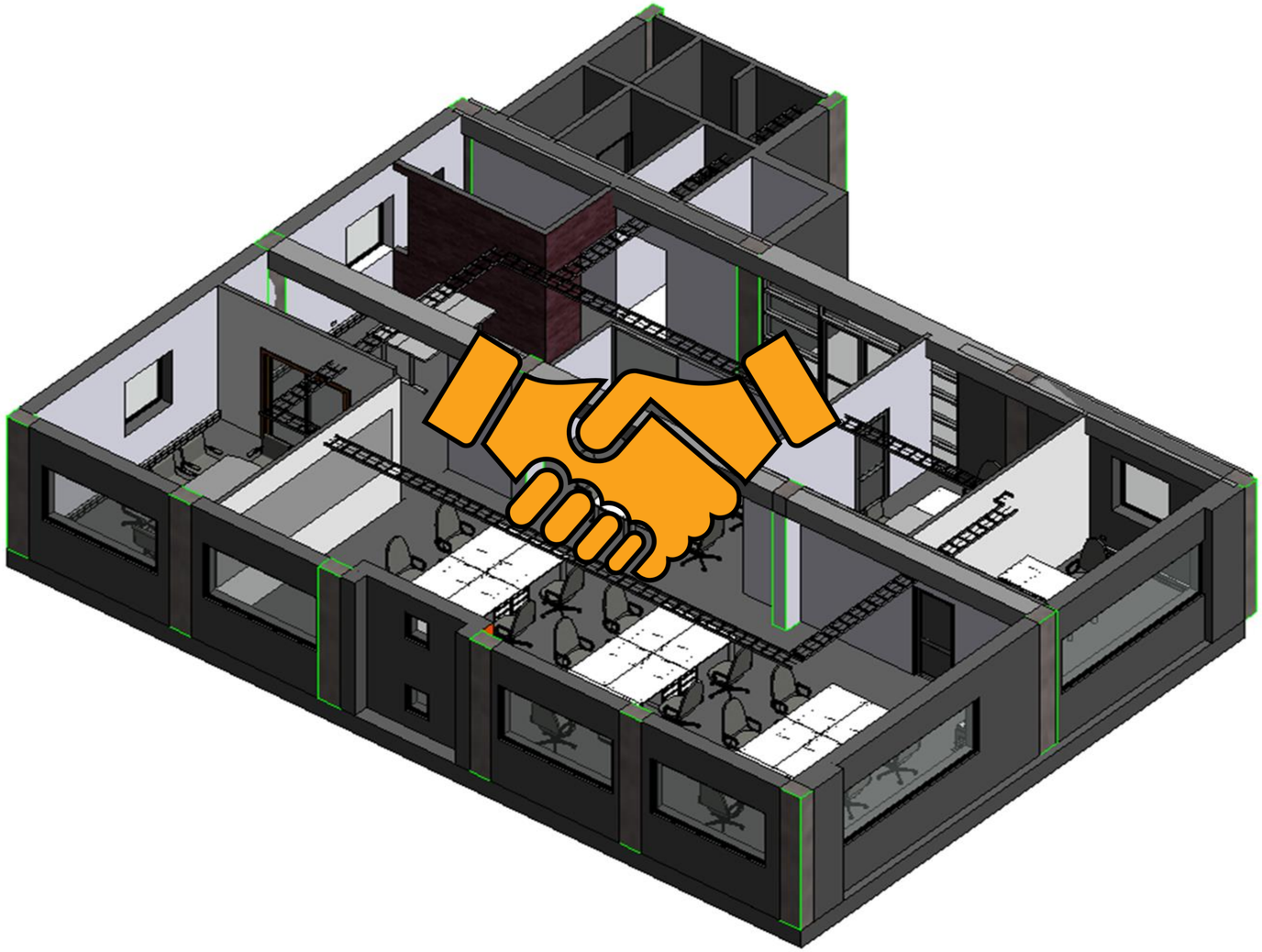


Office is Modelled (Scan Overlayed on Revit Model)

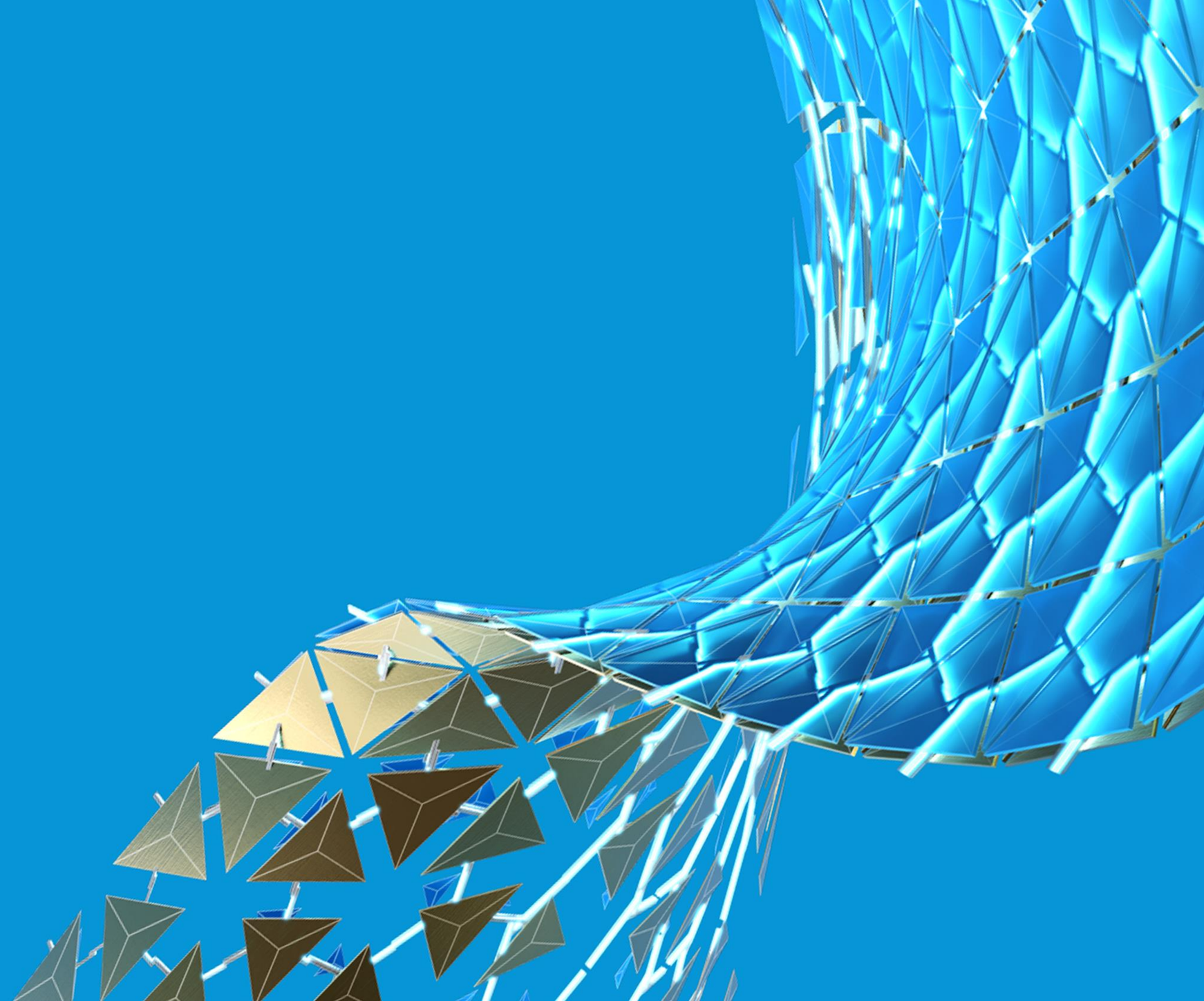
Office is Modelled (Geometry Extracted & Finalised)



Final As – Built Model Complete & Handed Over



Conclusion



Today`s Takeaways

- Automate as – built capture and the obtaining of measurements by embracing 3D Laser Scanning Technologies
- Incorporate point cloud extraction technologies to significantly reduce modelling time and design complexity, further automating the overall process
- Apply BIM intelligent tools to efficiently create data rich BIM models and model off extracted element data
- Combine point cloud data and photogrammetry with BIM Models to portray highly accurate and realistic visualisations
- Utilise stereo panoramic VR for enhanced visualisation

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